Insight into the Hg sources by stable isotopes of mercury in the largest Arctic river in North American

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Mercury (Hg), especially in its methylated form (MeHg), is a global environmental toxicant with the threat to wildlife and humans. Although the Arctic is void of anthropogenic Hg emission, the elevated Hg content in the Arctic food web shows the significant impact of global Hg contamination. Besides the atmospheric input, the Arctic rivers may also deliver a large amount of Hg, 44 ± 4 Mg per year (1σ) by observations and extrapolation, into the Arctic Ocean. However, the contributions of different sources to riverine discharge remain mostly unknown. This makes it challenging to reduce the anthropogenic Hg emission in the future, since this is messed by the natural Hg, including the precipitation Hg and the released Hg of permafrost thaw in response to the global warming. To anticipate the risk of Hg contamination in Arctic ecosystems, it is vital to identify the sources in the Arctic riverine.

Here, we collected and analyzed the set of river samples in Mackenzie River, the largest Arctic river in North America. The Hg concentrations and isotopic compositions show the spatial and temporal distribution, with the higher concentrations the particle Hg than dissolved Hg and the higher concentrations in downstream than upstream. Notably, the significant difference of Hg isotopic compositions between the particle and dissolved Hg, coupling with the carbon isotopes, shows that the atmospheric precipitation Hg is the primary source of the dissolved phase, higher proportion Hg of permafrost Hg contributes to the particulate Hg. This constraint of the Hg sources will be conducive to evaluate the future risk to Arctic aquatic ecosystems under the background of global climate warming.